



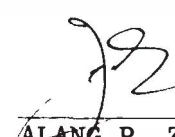
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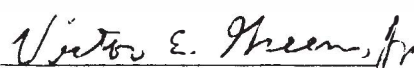
**WEED CONTROL IN DIRECT SEEDED RICE  
USING SELECTED HERBICIDES**


**AZMI BIN MAN**


**FP 1984 4**

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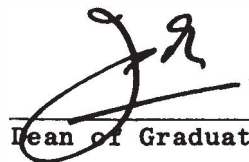
  
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WEED CONTROL IN DIRECT SEEDED RICE  
USING SELECTED HERBICIDES

by

A Z M I    B I N    M A N

A thesis submitted in partial fulfilment  
of the requirements for the degree of  
Master of Agricultural Science in the  
Universiti Pertanian Malaysia  
Serdang, Selangor.

December 1984



## DEDICATION

I should like to dedicate this work  
to my wonderful wife Normah bt. Talib  
for encouragement and help during the  
preparation of this thesis and to my  
daughters Nor Rumaizah and Nor Diyana.

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*An abstract of the thesis presented to the Senate of  
Universiti Pertanian Malaysia in partial fulfilment of the  
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*WEED CONTROL IN DIRECT SEEDED RICE  
USING SELECTED HERBICIDES*

*by*

*Azmi Bin Man*

*Supervisor : Professor Madya Dr. Lim Eng Siong*

*Co-Supervisor : En. Sabudin Bin Md. Ali*

*Faculty : Agriculture*

*Selected herbicides for the control of weeds in direct  
seeded rice were studied. The phytotoxicity of the herbicides,  
2,4-D amine, 2,4-DIBE-butachlor, butachlor, benthocarb and molinate  
were evaluated in two studies using petri dishes and plastic pots.  
A field study was also carried out to determine the efficacy of weed  
control of 2,4-DIBE-butachlor, butachlor and molinate.*

*2,4-D amine and benthocarb were found to be highly  
phytotoxic when applied as a preemergent and as an early post-  
emergent. Molinate was safe to apply as a preemergent. All the  
herbicides evaluated were more toxic when applied during the early  
postemergent period 14 days after sowing than when applied later at  
35 days after sowing.*



*It was found that the major weed problem in direct seeded rice fields was Echinochloa crusgalli (Linn.) P. Beauv. The most effective herbicide for its control was molinate. Application of this herbicide at rate 3.3 kg a.i./ha either seven days before sowing or fourteen days after sowing was effective.*

*An increase in yield in the range of 59 to 107 percent over unweeded plots was obtained with the use of molinate for weed control. For the additional expenditure on the herbicide application, a six-fold return was obtained.*





*Abstrak tesis yang diserahkan kepada Senate Universiti  
Pertanian Malaysia sebagai memenuhi sebahagian dari keperluan-  
keperluan untuk Ijazah Sarjana Sains Pertanian.*

*WEED CONTROL IN DIRECT SEEDED RICE  
USING SELECTED HERBICIDES*

*Oleh*

*Azmi Bin Man*

*Ketua Penyelia : Profesor Madya Dr. Lim Eng Siong  
Penyelia : En. Sabudin Bin Md. Ali  
Fakulti : Pertanian*

*Beberapa racun herba dipilih untuk kajian kawalan rumpai  
pada tanaman padi tabur terus. Fitotoksisiti racun-racun herba,  
2,4-D amine, 2,4-DIBE-butachlor, butachlor, benthocarb dan molinate  
diselidiki dalam dua kajian menggunakan petri dish dan pasu. Suatu  
kajian di sawah untuk menentukan keupayaan kawalan rumpai oleh  
2,4-DIBE-butachlor, butachlor dan molinate juga dijalankan.*

*2,4-D amine dan benthocarb didapati sangat fitotoksik  
bila digunakan sebagai pra-cambah dan awal lepas-cambah. Molinate  
adalah selamat digunakan sebagai pra-cambah. Kesemua racun-racun  
herba yang dikaji adalah lebih toksik bila diberikan awal lepas-  
cambah 14 hari selepas tabur dari bila diberikan lewat pada 35 hari  
selepas tabur.*

*Rumpai yang penting didapati pada tanaman tabur terus ialah Echinochloa crusgalli (Linn.) P. Beauv. Racun herba yang sangat berkesan mengawalinya ialah molinate. Masa pemakaiannya pada kadar 3.3 kg b.a./ha ialah tujuh hari sebelum tabur atau empat belas hari selepas tabur.*

*Pertambahan hasil di antara 59 ke 107 peratus ke atas petak tanpa kawalan rumpai telah didapati dengan penggunaan molinate. Untuk tambahan perbelanjaan ke atas pemakaian racun herba, pulangan sebanyak enam kali ganda telah diperolehi.*

CHAPTER I  
INTRODUCTION

In Peninsular Malaysia, rice is generally transplanted. Direct seeding of rice has only recently been introduced. The total hectarage of direct seeded rice crops is still relatively small compared to that planted by the conventional transplanting method (Table 1). Currently about 10,000 hectares of rice are direct seeded. This figure represents only 5 per cent of the total rice area. However, direct seeding of rice offers many advantages over transplanted rice and is expected to be widely adopted. The benefits of direct seeding over transplanting include ease of planting and reduced labour requirements, earlier maturity of 10 to 15 days and higher yields of as much as 66 percent more (IRCN, 1981).

TABLE I. HECTARAGE OF MAJOR RICE GROWING AREAS IN PENINSULAR MALAYSIA (BAKI, 1982b).

Region	Total Area Cultivated (Hectare)	Area Under Direct Seeding (Hectare)
Tanjong Karang	18,000	2,000 - 2,400
Kerian	23,600	0
Seberang Perak	9,090	400 - 440
Pulau Pinang	12,800	80 - 120
Muda Area	94,800	6,000 - 6,400
Kemubu Area	32,400	0



In spite of the advantages of direct seeding, a major problem in a direct seeded rice crop is weed control. In direct seeding, the rice seeds germinate at the same time as the weed seeds and it is difficult to carry out manual weeding. In transplanted rice there is a competitive advantage over weeds at the time of planting and weeding is easy due to the systematic plant arrangement.

In direct seeded rice, due to the problems associated with manual weeding of the crop it appears that the use of herbicide may be the solution to the weed control problem. In Malaysia, phenoxy herbicides (e.g. 2,4-D) have been widely used by farmers for the control of broadleaf weeds in flooded rice (Saharan, 1977). However, with direct seeding of rice, the weeds generally encountered are grasses because the field is not flooded during seeding. Therefore, herbicides suitable for the control of such grass weeds are necessary. Recently several promising herbicides for the control of various weeds have been introduced into the country. However, these have yet to be evaluated for their effectiveness in direct seeded rice crops locally. Hence, the present study was conducted with the following objectives :-

1. To determine the phytotoxic effect of selected herbicides on rice plants.
2. To determine the optimum time for the application of selected herbicides.
3. To determine the effectiveness of selected herbicides for the control of major weeds in a direct seeded rice crop.

# CHAPTER III

## LITERATURE REVIEW

### Weed Species in Flooded Rice Growing Areas of Malaysia

In flooded rice fields the weeds encountered may be classified into broadleaves, sedges, grasses and aquatic plants. In Peninsular Malaysia, a conglomeration of 78 species belonging to 38 genera in 28 families was recorded in five main rice growing areas as shown in Table II (MARDI Ann. Rep. 1982). These species may be subdivided into annual and perennial weeds. The annuals include 5 grasses, 21 sedges and 22 broadleaves. The perennials consist of 12 grasses, 12 sedges and 6 broadleaves. However, only 36 of these species were considered important. They formed about 94 to 96 per cent of the total weeds present in the areas studied.

TABLE II. WEED SPECIES IN THE MAIN RICE GROWING AREAS OF PENINSULAR MALAYSIA (TANJONG KARANG, KERIAN, PULAU PINANG, MUDA AREA AND KEMUBU AREA) (MARDI ANN. REP. 1982)

Family	Species	Life Cycle <sup>a</sup>
Gramineae	<i>Brachiaria mutica</i> (Forssks.) Stapf	P
	<i>B. milliformis</i> (Presl.) C.E. Hubb	P
	<i>Echinochloa crusgalli</i> (L.) Beauv	A
	<i>E. colonum</i> (L.) Link	A
	<i>E. crusgavonis</i> (H.B.K.) Shult	A
	<i>Eragrostis atrovirens</i> (Desf.) Trin. ex. Steud	P
	<i>E. anabilis</i> (L.) P. Beauv	A
	<i>Isachne globosa</i> (Thumb) O. Ktze	A
	<i>Ischaemum indicum</i> (Houtt) Merrill	P
	<i>I. muticum</i> L.	P

TABLE II. CONTINUED

Family	Species	Life Cycle <sup>a</sup>
Gramineae	<i>Leersia hexandra</i> Swartz	P
	<i>Oryza</i> spp	A
	<i>Panicum amplexicaule</i> (Rudge) Nees	P
	<i>P. auricum</i> Ridl	P
	<i>P. repens</i> L.	P
	<i>P. sarmentosum</i> Roxb	P
	<i>Paspalum conjugatum</i> Berg	P
	<i>P. vaginatum</i> Swartz	P
	<i>P. commersonii</i> Sensus Ridl	P
Cyperaceae	<i>Cyperus aromaticus</i> (Ridley) Mattf. Kukenth	A
	<i>C. babakan</i> L.	P
	<i>C. compressus</i> L.	A
	<i>C. diffusus</i> Vahl.	A
	<i>C. distans</i> L.	P
	<i>C. digitatus</i> Roxb	P
	<i>C. esculentus</i> L.	P
	<i>C. ferax</i> (L.) Rich	P
	<i>C. haspans</i> L.	P
	<i>C. iria</i> L.	A
	<i>C. luzule</i> (L.) Retx	A
	<i>C. odoratus</i> L.	P
	<i>C. malacensis</i> L.	P
	<i>C. pilosus</i> (L.) Vahl	P
	<i>C. rotundus</i> L.	P
	<i>Eleocharis cruspavonis</i> L.	P
	<i>E. chaetaria</i> (R.Br.) Roem & Schultes	A
	<i>E. geniculata</i> (L.) R & R	A

TABLE II. CONTINUED

Family	Species	Life Cycle <sup>a</sup>
Cyperaceae	<i>E. retroflexa</i> (R.Br.) Kunth	A
	<i>Fimbristylis acuminata</i> Vahl	A
	<i>F. dichotoma</i> (L.) Vahl	A
	<i>F. diphylla</i> L.	A
	<i>F. globulosa</i> (Retz) kunth	A
	<i>F. milliacea</i> (L.) Vahl	A
	<i>F. retroflexa</i> (L.)	A
	<i>F. schnoides</i> Vahl	A
	<i>Fiurena umbellata</i> Rottb.	A
	<i>Rhynchospora corymbosa</i> (L.) Britt	P
	<i>Scirpus grossus</i> (L.)	P
	<i>S. juncoides</i> (L.) Roxb	A
	<i>S. laterifolius</i> (L.) Gmel	A
	<i>S. mucronatus</i> L.	A
Onagraceae	<i>Jussiaea linifolia</i> Vahl	A
	<i>J. repens</i>	A
	<i>J. suffructicosa</i> Nutt	A
Pontederaceae	<i>Monochoria elata</i> Ridl	A
	<i>M. vaginalis</i> (Burm.f.) Presl	A
Marsileaceae	<i>Marsilea crenata</i> Presl	A
Salviniaceae	<i>Salvinia auriculata</i> Aublet	A
Scophulo- riaceae	<i>Lindernia pendunculata</i> Linn	A
	<i>Limnophylla heterophylla</i> Berth	A
Lentubula- riaceae	<i>Utricularia flexuosa</i> Vahl	P

TABLE II. CONTINUED

Family	Species	Life Cycle <sup>a</sup>
Butomaceae	<i>Limnocharis flava</i> Buch	A
Alistamaceae	<i>Sagittaria guyanensis</i> Humb	A
Convolvulaceae	<i>Ipoemea aquatica</i> L.	A
Rubiaceae	<i>Oldelandia dichotoma</i> (L.) Roxb.	A
Nymphaeaceae	<i>Nymphae lotus</i> L.	P
	<i>Nymphoides humboldtianum</i> (H.B.K.) Kuntze	P
Companulaceae	<i>Sphenoclea zeylanica</i> Gaertn	A
Lemnaceae	<i>Lemna minor</i> L.	A
Ceratophyllaceae	<i>Ceratophyllum demersum</i> L.	A
Amaranthaceae	<i>Alternanthera triandra</i> Lank	P
Azollaceae	<i>Azolla pinnata</i> R.Br.	A
Xyridaceae	<i>Xyris pauciflora</i> Keohne	A
Lythraceae	<i>Rotala indica</i> Keohne	A
Hydrocharitaceae	<i>Blyxa malayana</i> Ridl	A
	<i>Hydrilla verticillata</i> Presl.	A
Parkeriaceae	<i>Ceratopteris pteridoides</i> (Hook) Hieron	A

<sup>a</sup>P - perennial

A - annual



### Crop Losses Due To Weeds

Weeds compete with rice directly for light, nutrients and soil moisture. Indirectly, weeds cause the lowering of water and soil temperature, harbour disease pathogens and insect pests and cause other environmental disturbances such as blockage of irrigation canals and water pollution (Kusanagi, 1981).

Infestation by weeds, besides reducing yield and grain quality also increase the cost of pest control, harvesting, drying and cleaning operations (Chang, 1965; De Datta *et al.*, 1968; Anwar, 1978). Various values have been reported from different countries on the loss of rice yield due to weeds. Okafor and De Datta (1974) reported grain yield losses due to weeds alone in upland rice in the range of 83 to 100 per cent. In Asia, the annual rice crop losses due to weeds were estimated to be 11.8 per cent of the potential production (De Datta, 1981); in India, the yield losses were estimated to 10 per cent (Bharwaj and Verma, 1969); U.S.A. around 15 per cent (Smith *et al.*, 1977) and the corresponding figure for the world is 9.5 per cent (De Datta, 1981).

The reduction of rice yield due to weeds is more severe in direct seeded than transplanted rice. In Taiwan, Chiang and Leu (1981) reported that weed competition resulted in mean yield loss of 16 per cent for transplanted rice and 62 per cent for direct seeded rice. The estimated yield reduction in Korea was 20.8 per cent for transplanted and 40 per cent for direct seeded rice (Kil, 1981). The percentage of yield reduction in transplanted rice in Malaysia